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THE

METHODS OF PERFORMING ELECTROLYSIS

IN

ANEURISMS, NÆVI, AND OTHER BENIGN
TUMORS.

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THE success of the electrolytic procedure in aneurism, varicose veins, nævi, cystic and other benign tumors, depends on the method used. One may fail by one process and succeed by another, just as in any other surgical operation. The tendency has been to be satisfied with the mere employment of galvano-puncture, without regard to the method, and to accept the results, whether favorable or unfavorable, as serving to settle the question of the value or uselessness of electricity in surgery.

In electrolysis everything depends on the method; and with the same method, skill, care, and thoroughness may succeed when awkwardness, carelessness, and inattention fail utterly. The failure of elec-

trolysis in any form of tumor, benign or malignant, is not to be counted a reproach until we know the actual method used and the character of the operator.

The method of electrolysis of the base or working up the base, that I have employed in the treatment of malignant tumors, I have elsewhere* described in detail. I have here to speak only of ordinary electrolysis, where the needles, insulated or non-insulated, are plunged directly into the tumor.

The errors that have been and are continually made in electrolytic operations begin and end in ignorance or forgetfulness of the laws and facts of electro-physics and electro-physiology, and especially of the former. No one can be a scientific and successful electro-surgeon without also being more or less of an electro-physicist.

ANEURISMS.

In the treatment of aneurism, the great end sought is coagulation. A knowledge of the differential action of the poles in producing coagulation is essential to an intelligent use of electricity in treating aneurism. Coagulation takes place at both poles of the galvanic current; that at the positive pole being small, black, and hard, and that at the negative being larger, softer, and of a yellowish color.

Aneurisms may be treated with greater or less success, according to their size and position, the condition of their walls, and general health of the patient, by either of the poles, or by both combined.

The best method for the majority of cases, cer-

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tainly for aneurisms of any considerable size, is to use both poles, and a large number of needles that are insulated so that the current will not act on the walls of the aneurism. In the treatment of aneurism, especially, careful insulation is needed. The advantage of using both poles is twofold.

First, a double clot is formed, one at the positive and the other at the negative pole. Although the negative clot is soft and yielding, still, in combination with the positive clot, it is of decided service in closing the aneurism ; and, so far as I can ascertain, there is no evidence that embolism is ever caused thereby.

Secondly, the resistance is greatly reduced by placing needles connected with both poles in the sac, so that the electrolytic action is very much more effective than when one pole is placed on the surface of the body. The blood is the portion of the body that best conducts electricity ; and when both poles are inside of the sac and near to each other, as of course they must be, a mild current will cause vigorous electrolysis. On the other hand, if one pole be applied by a wet sponge to some indifferent point on the surface, a strong current is needed to produce a clot, and a long operation ; and, unless the sponge on the surface is occasionally moved, it would cause great pain ; and if the patient is under an anæsthetic, a blister may be caused. As the negative pole is more painful than the positive when the positive alone is in the aneurism, the negative on the surface may be very uncomfortable even with a feeble current.

In the electrolytic treatment of aneurism, as in so many other electrical applications, it is an advantage to have a rheostat, so as gradually to let the current on or off without shock.

STATISTICS OF ANEURISM TREATED BY ELECTRICITY.

The published statistics of aneurism treated by electricity are of little or no value, and for two reasons. 1. They represent experiments made, in a large percentage of the cases, by those who are but little familiar with electro-physics or electro-physiology. Quite frequently the poles have been confounded, so that it is impossible to tell whether the positive or negative is used, and from many of the accounts it is impossible to tell even approximately the strength of current used.

2. The statistics are derived in part, at least, from cases that are reported too early. The temporary relief that results from the coagulum formed in the aneurism by the chemical action of the current has been interpreted as indicating a perfect recovery.

Some of the cases hastily reported as cured probably died soon after, if not before the account of their recovery was fully in print.

For these reasons I omit all the statistics that have appeared on this subject, preferring the general average opinion, so far as it can be obtained, of those surgeons and electro-therapeutists who are best qualified to speak on this subject.

My general conclusion, derived from many experiments on animals, from actual experience, and from a comparison of the various observations that have been made on the subject, is, that for those varieties of aneurism—such as the thoracic, abdominal, etc.—that cannot well be treated by the old methods, and in some cases for those that are accessible to other treatment, galvano-puncture, rightly performed, may be of great service in relieving the accompanying symptoms, and in prolonging life, and in some cases may effect a perfect and permanent cure.

VARICOSE VEINS.

Varicose veins were treated by galvano-puncture, after the manner of aneurisms, many years ago. For the treatment of varicose veins the positive pole would probably be better than the negative, or than both together, and for the reasons above given. The space within the enlarged vein is comparatively small, and the small clot made by the positive pole ought to be sufficient to obstruct the *flow* of blood. The positive clot would have the advantage of firmness, and embolism would be less likely to follow than after the use of the negative pole.

NÆVI—ERECTILE TUMORS—ANGEIOMATA—MOTHERS' MARKS.

This variety of tumors may be treated by the ordinary method of electrolysis, with a good probability of success, provided the conditions of success are skilfully observed.

It is first of all necessary to understand that to cure all forms of erectile tumors electrolytically without leaving any scar or trace is simply impossible. In many cases, and notably in those of larger size, and which are partly cutaneous and partly sub-cutaneous, sooner or later destruction of tissue is requisite to bring about a cure; and destruction of tissue after electrolysis, like destruction of tissue after the use of other agents, is followed by cicatrization.

When the nævus is small and superficial, then a mild electrolytic operation may be followed by a shrinking of the tumor and a rapid and permanent absorption of the *débris* without any scar; but such cases can hardly be said to constitute the majority. The scars following the electrolytic treatment of nævi may, however, rapidly disap-

pear ; at least, the little patient may in time entirely outgrow them.

It is necessary to be understood, in the second place, that the electrolytic operations for *nævi*, as for other kinds of morbid growths, are usually sufficiently painful to require some form of local or general anæsthesia. It is almost absolutely safe to give ether to young children ; and the operation, even though it be but very short and but little painful, can be conducted far more successfully when the child is anæsthetized than when it is not. With adults, and sometimes with children, local anæsthesia by ether-spray is sufficient ; but it is generally inferior to general anæsthesia. The struggles of the child to get free, its terror at the sight of the instruments, can all be saved by a carefully-administered anæsthetic.

The details of the operation differ with the size and character of the tumor. Success has followed the use of both poles in the tumor, or only one, while the connection is made by a sponge electrode on some indifferent point. If the tumor be small, and but one pole is used, it is better that it should be the positive, since the clot found at the positive pole, though small, is hard and firm. If the tumor be large, needles connected with both poles may be used. Whether one or more needles are to be used depends on the size of the tumor ; but generally one needle connected with each pole is sufficient. If many needles are used, it is difficult to manage them ; and some may fall out, and thus disturb the operation. It is better, as a rule, to take out the needle at different stages, and insert it in various parts, until the entire growth is acted upon. I have sometimes found it of advantage to reverse the current during the operation, so that all portions of the tumor may be acted on by both

poles. Insulation of the needles is only required in the case of entirely subcutaneous tumors—where, as in the case of aneurism, it is desired to produce a coagulum (which may be slowly absorbed) without injury to the skin.

The length of the operation may range between five and twenty-five minutes, according to the strength of current used, the size of the needles, and the size of the tumor.

The great point in all electrolytic operations for nævi *is to do just enough without doing too much*. If the operation be not reasonably thorough, absorption will not take place, or the tumor may recur. If the operation be too extensive or prolonged, the destruction of tissue may be greater than is needed, and the subsequent cicatrization may amount to at least a temporary deformity. For very large and semi-subcutaneous nævi, that exhibit a tendency to spread in all directions, it is necessary to place the needles at or near the base of the tumor, and in the surrounding tissue, among the enlarging and tortuous vessels, in a manner somewhat resembling the method of electrolyzing the base of malignant tumors. If such tumors are treated timidly, no good result will come, and the operation may be several times repeated without satisfaction.

The advantages of the electrolytic procedure in nævi are these : 1. In small and superficial tumors the cure may be effected with little or no scar. On the face and other exposed parts of the body, this advantage is very great. 2. In the large nævi, and those which are partially or entirely subcutaneous, the liability of recurrence would be less, and probably the extent of the cicatrization would be less, than after the ordinary method of treating these growths.

GOITRES.

Goitres are to be treated by ordinary electrolysis with sharp, bayonet-shaped needles, which may be either insulated or non-insulated. Needles that are smoothly insulated can be inserted through the skin of the neck without very much more difficulty than non-insulated needles. But if the insulation be roughly put on, the difficulty in insertion may be very great. An advantage of non-insulated needles is that by the action which takes place in the skin around it the needle becomes loosened at the negative pole, and so can be pushed in still farther without difficulty. For goitres of all kinds, the negative pole is much preferable to the positive pole, and for the same reasons as in cystic and fibroid tumors. It is better not to connect any needle with the positive pole, but to complete the circuit by a sponge electrode applied over the surface of the tumor. There is no danger in inserting a needle even into a small goitre to a considerable depth, say one or two inches. By great carelessness it would, I suppose, be possible to wound the carotid artery. I do not usually employ an anæsthetic in the operations on the neck. I find that the ether-spray, or the local application of a mixture of carbolic acid and ether, prevents, to a considerable extent, the pain of the introduction, which the patient much dreads, and which is really more severe than the pain of the electrolysis after the needles are in position.

In a few cases I have observed that the needles, when inserted in a goitre, cause, by reflex action, pain in the forehead; in other cases, nausea and a tendency to faintness are observed. The majority of patients do not fear an operation of more than

from five to fifteen minutes, which may be repeated two or three times a week.

This purely electrolytic treatment may be varied by external galvanization and faradization, with strong currents.

There is no question that external galvanization and faradization with strong currents, both steady and interrupted, will cause a considerable reduction in the size of goitres; and even when these methods do not cause any perceptible diminution, they at least relieve the sense of pressure, the heaviness, and the sense of suffocation or of choking that goitres often cause. External electrization alone is not so satisfactory as electrolysis with needles.

The prognosis of goitre under electrical processes varies with the nature of the tumor. Those which are small and soft may disappear entirely and permanently. Those that are large, provided they are not too hard, may also entirely disappear. The cystic varieties also give a good prognosis. Those that are both very large and very hard may diminish a certain percentage, but they do not entirely disappear. The best method of estimating the results of treatment is to take measurements of the neck. Almost all goitres will go down more or less, and usually at the outset of the treatment. Afterwards they recede more and more slowly; and, even in those cases where the cure is complete, the last quarter will require more treatment than the first three quarters. This is true of all solid growths that are treated by electricity.

CYSTIC TUMORS.

Benign cystic tumors may be successfully treated by the ordinary method of electrolysis. I have treated a number of cases, small and large, and with excellent results. The object of the electro-

lytic procedure in benign cystics is, of course, very different from the object of the same procedure in *nævi*. The therapeutical action of the current on cystics is somewhat complex. 1. The fluid is decomposed. The gaseous products of this decomposition sometimes escape through the holes made by the needles. 2. The walls of the cyst are stimulated, so that the fluid is absorbed, and thus the tumor is caused to shrink. This is, in fact, the *rationale* of electrolysis in hydrocele. 3. Decomposition of the walls of the cysts. This takes place, of course, only when uninsulated needles are used. When the needles are insulated near to the end, the walls of the cyst are not acted on. 4. Evacuation of the fluid contents of the cyst without decomposition. This result may follow puncture of any kind, even when no electricity is used. It is more likely to follow electrolysis with the negative needle, for the reason that the needle, when not insulated, acts on the walls of the cyst and enlarges the opening made by the needle.

In operating on cystic tumors by electrolysis, the best procedure is to insert needles connected with both poles. The positive needle may be kept fixed, while the negative is worked in various directions, so as to act upon all the inner surface of the cyst, and also to enlarge somewhat the hole made by the needle in the walls of the tumor, and thus allow free exit of the fluid or gases.

Large, long, cutting needles are usually preferable when the tumor is large; but for small tumors almost any kind of needle will answer.

Hydrocele is treated electrically on the same principle as cystic tumors. The mere evacuation of the fluid, or the electrolysis of it, accomplishes but little unless the secreting surface is acted on by the current.

FIBROIDS.

Fibroids are usually hard, and therefore slow to decompose under electricity. This is true of all fibroids, wherever situated,—in the neck or any portion of the periphery, or in the uterus. Inasmuch as they are not usually malignant, the method of electrolyzing the base is not needed. They are to be treated by ordinary electrolysis, needles connected with both poles being inserted in the tumor. The needles may be insulated or non-insulated, according to the situation of the tumor.

The behavior of fibroids after electrolysis is not generally satisfactory: the amount of decomposition, on account of the density and comparative dryness of the tissue, is but slight, and the subsequent shrinkage and atrophy are not so marked as in goitre or cystic growths.

If a current of sufficient strength be used, the patient being anaesthetized, suppuration may be excited, and, as a result of the destruction and loss of tissue, the tumor may become somewhat smaller.

Fibroids of the uterus are of sufficient importance to be specially considered. They may be treated electrolytically, either through the vagina or through the abdominal walls, according to the position.

The danger of creating peritonitis by thrusting needles through the abdominal walls is but slight, and if the needles are well insulated by rubber there is really no danger. The insulated part should, of course, go beyond the peritoneum.

Dr. Kimball, of Lowell, reports excellent results from treating fibroids in this way. My own observations in this direction have not been of the most encouraging nature. I have never seen a large and hard fibroid tumor disappear under electrolysis.

Relief of pain, of neuralgia, of anæsthesia, and of many of the other attendant symptoms, I have many times obtained, but never a complete or approximate dispersion of the tumor.

LIPOMATA (FATTY TUMORS).

Ordinary surgical treatment with the knife is so successful for fatty tumors that electrolysis would hardly be indicated, even if it could accomplish as much and as easily as the knife. Fatty tumors are, of course, benign, and when operated on do not recur. Fat decomposes slowly and with difficulty, and is not subsequently absorbed, at least to any marked degree. I have experimented on a number of cases of fatty tumors, small and large; but, although some slight reduction in size can be gained, the results have never been satisfactory.